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Game On: Redesign of a Teacher Professional Development Platform for Use with the Serious Game *Alien Rescue*

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Game On: Redesign of a Teacher Professional Development Platform for Use with the Serious Game *Alien Rescue*

by

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Dedication

This report is dedicated to my friends and family, who were invaluable in the course of my completion of this program and this product. Without your unflagging support and encouragement, and your devotion to keeping me fully stocked on ramen and pizza, I could not have fully succeeded in this endeavor. Your importance to me cannot be overstated; thank you so much. Thank you also to my mentor and first reader, Dr. Min Liu, and my second reader, Dr. Karen French for helping me make this report the best it could be. It is also dedicated to my teachers and professors from elementary to graduate school, especially those who acted as mentors and advisers—and sometimes as guardians and friends. You taught me to reach for the pinnacle and to recognize that there is always something beyond.

Acknowledgements

I would like to acknowledge Ellen Zou, my partner in this redesign project (and a far better coder than I), the developers of and contributors to W3 Schools, Lynda.com, Stack Overflow, and all of the other inestimable resources that helped me gain the skills necessary for this work, and my French press for being ever willing to keep me as ridiculously over-caffeinated as necessary.

Abstract

Game On: Redesign of a Teacher Professional Development Platform for Use with the Serious Game *Alien Rescue*

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The University of Texas at Austin, 2016

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Abstract: This report explores the design and development process of a teacher professional development platform and digital teacher's manual for use with the serious game *Alien Rescue*. It begins with a comprehensive overview of current best practices informing professional development, specifically for use with serious educational games and other educational technologies. The design considerations, methods, layout, and goals of the platform, called the *Alien Rescue* Teacher Portal (the Portal), are described. Evaluation methods and subsequent revisions made to the Portal are then detailed. Finally, overall evaluation of the process and product in light of best practices and future directions are discussed.

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Chapter 1: Introduction and Problem Statement

Alien Rescue is an inquiry-based, problem-driven serious game for use in the middle school science classroom and has been specifically developed to align with national and state-based standards of the 6th-grade science curriculum. This game asks students to use inquiry and scientific methodology to find new homes within our solar system for six alien species whose own home galaxy has been destroyed. *Alien Rescue* has been available for classroom use for 15 years and has received wide-spread adoption. Sixteen middle schools in Central Texas alone as well as thirty other states and four countries have adopted the program. However, the support provided to teachers has not overcome teacher hesitancy to use and fully incorporate the game into their science curricula.

Part of this hesitancy may be attributed to misunderstanding of the game, how it should be implemented in the unit, how to assess student progress and the knowledge students should be gaining, and how the game aligns with national and state standards. While this information is currently available in a wiki-based platform provided for teachers, it may be that the content is not readily presented and accessible in a way that overcomes uncertainty about using a serious game in the classroom.

As Callister and Dunne (1992) have stated, “If the teacher does not know

what to make of the tool, or fears it, or misconstrues its uses, it will be used badly or not at all" (p. 325). Many technology tools have been introduced to educational settings that have at the least not been used for their purpose or potential or at worst actively detracted from learning. Though sometimes the tool is of poor design or flawed concept, often problems stem at least partly from a lack of understanding necessary to incorporate the product into the classroom as effectively as it could be (Groff & Mouza, 2008).

The question is: what is the best method to help teachers gain this understanding of learning tools? Knowing that teachers are extremely time-constrained and their ability to pursue comprehensive professional development limited (Kopcha, 2012), how can product-specific support be packaged so that it is possible to deploy that product in the classroom as intended with maximum instructor comprehension and minimal time investment? This report explores best practices in online-based professional development for teachers, specifically for learning to teach with a specific technology or educational context, and to apply these to the design of a platform for teachers to use with the serious game *Alien Rescue*. Once the platform has been designed, it will be developed and launched for teacher use with the updated version of *Alien Rescue*. My guiding research questions in the course of this project are as follows:

1. How does a professional development platform aid effective classroom integration of technologies and educational games?

2. What is the best user-interface design and medium for a teacher's PD platform for use with an educational serious game?

While the goal of this study is to answer these questions, the purpose of doing so and the desired result will be the development of a professional development platform and development model that can be easily tweaked, updated, and variegated upon for future use with other technologies and contexts.

This report is organized in the following manner: first, a review of the relevant literature is presented as it pertains to professional development in general, inquiry-based learning, and game-specific professional development. Following this, I will discuss the current platform used to support teachers in their use of *Alien Rescue* and present the design and design considerations of the newly created platform. Feedback for this design will be relayed in the Field Testing section, and finally how that feedback was incorporated, process experience, and next steps will be discussed.

The purpose of this arrangement is to:

- provide foundational support for design of the new platform,
- assess the efficacy of the platform model,
- apply insight into teacher's habits, tendencies, and desires for context-based professional development to design and redesign, and
- provide a viable and potential future model for PD platforms with next-steps highlighted.

Chapter 2: Relevant Literature

BACKGROUND

In the field of education, professional development has come to cover a broad range of methods, goals, activities, and interactions meant to strengthen the ability of the teacher to achieve learning objectives efficiently and effectively, but the term itself often comes attached to models and programs that fail to engage teachers and positively impact their instruction (Guskey, 2003; Hill, 2009). Because this report is focused on researching and abiding by best practices in designing for professional development, it will be helpful to connect concepts and conclusions to a clear definition of what professional development *is*.

One concise definition has been presented to the field by the National Professional Development Center on Inclusion for use with early childhood professional development (though in general it seems applicable to a broader audience). It follows:

> The key components of professional development include (a) the characteristics and contexts of the learners (i.e., the **who** of professional development) … (b) content (i.e., the **what** of professional development: what professionals should know and be able to do) … and (c) the organization and facilitation of learning experiences (i.e., the **how** of professional development: the approaches, models, or methods used). (Buysee, Winston, & Rouse, 2008, p. 239.)

This definition, containing all relevant contexts, seems a logical place around which to design a professional development platform as well as lens through which to understand current research.

A 2008 technical report by the Stanford Center for Opportunity Policy in Education found that for secondary teachers, professional development in the areas of content, student discipline, and instructional technology rated highest in terms of importance (23.7%, 19.9%, and 13.7% respectively; Wei, Darling-Hammond, & Adamson, 2010). Problems in all three of these areas can be highly correlated; without proper professional development in one's content area, it is difficult to retain classroom discipline or adapt curriculum to utilize the affordances technological tools and without training in the use of these tools, content will suffer and—again—order will be difficult to keep (Hew & Brush, 20017; Ross & Bruce, 2007). Many teachers fear that students will misuse the technologies they are provided and are fearful of classroom implementation and of heavy dependence on these kinds of tools (Wei, et al., 2010). As well, allowing a curriculum to rely heavily upon a new technology or way of teaching can be daunting for teachers due to assessment and high-stakes testing pressures and can act as a barrier to trying (Hew & Bush, 2007).

Some of the hesitancy toward *Alien Rescue* may indeed arise from the fact that it is not designed to be a supplement to the existing middle school solar system and space science unit, but a new way to teach it entirely. Research shows that

technological devices in general continue to be used to support existing curriculum and as replacements for current classroom tools instead of in transformative ways achieved through a solid understanding of technological, pedagogical and content knowledge (TPACK) principles (Fu, 2013; Hughes, Kerr, & Ooms, 2005; Sprague, 2004).

Teachers are still learning to recognize technology's potential to be more than replacement or amplification of their existing practices, and truly transformative approaches may be intimidating (Hughes, Thomas, & Scharber, 2006). While instructors are encouraged and increasingly mandated to utilize current and new technologies in their instruction (Murley, Stobaugh, & Jukes, 2013), teachers are often not provided with the professional development (or the time to engage in it) needed to really understand these technologies, let alone understand how they fit in with their curricula and whether or how they can transform their classrooms and methods (Penuel, Fishman, Yamaguchi, & Gallagher, 2007; Al-Senaidi, Lin, & Poirot, 2009).

Where provided professional development is not sufficient, schools are increasingly ensuring their teachers have access to technologists who (preferably) can provide not only help de-bugging and getting to know different software and hardware, but also the curricular implications of these tools (Davidson, 2003; Davies, 2010), thus removing some of the onus from the teacher to learn the use and application of them on his or her own. These technologists can help the

teacher, often overburdened and short on time, find just-in-time information and tools for using certain technologies, aiding the teacher in balancing resources while ensuring enriched learning opportunities for the student (Davidson, 2003). In the same vein, the producers of educational products who wish for their products to be successfully implemented in the classroom need to take some responsibility in helping the teacher to do so in an efficient manner that takes into account the short amount of time teachers may have to devote to learning the new product (Davis & Krajcik, 2004).

Therefore, when one's aim is to introduce a technological tool to the classroom and especially when that tool will play a large role in curriculum presentation, the content it contains, how it aligns with learning goals, and exactly how it must be used (and whether or how it can be misused) needs to be explicitly related to the adopting teacher (Davis & Krajcik, 2005). In order to allay any hesitancy, this information must be clear and accessible, and it must be available for the teacher to view at any time, as well as derived systematically in order to achieve internal effectiveness (Richey, Klein, & Wayne, 2004).

INQUIRY-BASED LEARNING THROUGH TECHNOLOGICAL TOOLS

The discussed introduction of easily accessible and powerful technologies into education has changed the scope of learning and how it can be accomplished in the classroom. Information is now so readily available that the majority of classroom time does not need to be devoted to the presentation and memorization

of facts, but instead on the application and contextualization of these facts to the curricular objectives, which themselves can be of higher-order domains (Greenhow, Robelia, & Hughes, 2009; Hopson, Simms, & Knezek, 2001). This has led to a resurgence and improved practicality of project/problem- and inquiry-based learning (Crawford, et al., 2014), situating the learner in the activity of problem-solving and knowledge-seeking and the teacher as facilitator of this process. The use of inquiry-based learning is especially effective in the science classroom, since “science is essentially a question-driven, open-ended process and ...Inquiry activities provide a valuable context for learners to acquire, clarify, and apply an understanding of science concepts” (Edelson, Gordin, & Pea, 1999).

However, in order to effectively apply inquiry-based learning utilizing technology, the technological medium must be understood by the teacher in the context of the curriculum (Levin & Wadmany, 2008). This requires what is referred to as the Technological Pedagogical and Content Knowledge framework (TPACK; Mishra & Koehler, 2006). Research has shown time and time again that merely dumping a technology into a classroom without understanding how and why it should be applied in the curriculum is a recipe for failure (Warschauer, Zheng, Niiva, Cotton, & Farkas, 2014). How the content is supported through the technology, the impacts the technology has on pedagogical approach, and the technology’s affordances and constraints need to be understood if the product is

to be integrated smoothly into the curriculum and meet the objectives of the course or section (Harris & Hofer, 2009; Mishra & Koehler, 2006).

According to Harris and Hofer (2009), teachers' knowledge and planning regarding their instruction is situational and episodic in nature. It is contextually driven, and this implies that professional development and technological training needs to be situated in the context with which it will be used for greatest efficacy (Harris & Hofer, 2009). This is important when considering the gulf between the broad range of types, amounts, and pedagogical potential of technological tools for educational use and their actual representation in the classroom (Kopcha, 2011).

As educational standards change and the capabilities of technology grow and affect learning practices, teachers and schools rely more heavily on the development of high-quality curricular materials, lesson plans, and teaching strategies that they can adapt for their classroom, particularly in the areas of math and science (Roseman, Kulm, & Shuttleworth, 2001; Darling-Hammond et al., 2008). In their 2007 study, Penuel and colleagues examined characteristics of professional development provided to 454 inquiry-based science program teachers to research effectiveness. These researchers found that time provided to engage in professional learning and commitment to learning the content--as well as explanation of how that content was relevant to learning goals--left teachers better prepared to engage student inquiry and more likely to follow instructional

guidelines. Predictors of curriculum implementation lie in teacher understanding of the professional development's goals and how it aligns with their own (Garet, Porter, Desimone, Birman, & Yoon, 2001; Heath, Lakshmanan, Perlmutter, & Davis, 2010; Penuel, et al., 2007).

GAMES IN EDUCATION AND GAME-SPECIFIC PROFESSIONAL DEVELOPMENT

An increasingly explored avenue to create problem-driven, authentically situated learning is found in the use of both commercial and non-commercial digital games (Becker, 2007; Gee, 2007). Digital games provide an immersive environment wherein complex problem-solving strategies are often required and through which the ability to win or succeed promotes desire to solve the problem, competition, and agency (Becker, 2007; Squire, 2005). However, there is not a ready knowledge among educators about the potential for games in teaching their subjects (Granic, Lobel, & Engels, 2014), and there is active worry on the parts of both teachers and parents, mostly due to negative reports on the subject, that video games in general may have negative consequences (Kenny & McDaniel, 2009). In an environment where a high amount of emphasis is placed on standards alignment and high-stakes assessment, inclusion of digital games in the curricula might seem like a risk if these concerns are not readily addressed and allayed (Kenny & Gunter, 2011).

As Becker (2007) notes, "Professional development offerings are desperately needed as ways to provide basic games literacy as well as to help

develop teachers who can add this new medium to their repertoire" (p. 7). While there may be hesitancy to even consider that a game can be educationally relevant, there is even less teacher knowledge of how to effectively incorporate video- and serious games into their classrooms (De Grove, Bourgonjon, & Van Looy, 2012). While games may not be a silver bullet in education, that does not mean they cannot be a valuable tool. Games are inherently participatory simplifications of reality (Schaffer, Squire, Halverson, & Gee, 2004); they allow players to inhabit other bodies, other worlds, and therefore are powerful mediums in creating immersive environments from which students can learn by actively doing. However, much of their educational potential necessitates purposeful, informed use, and therefore requires teacher awareness and professional development (Oblinger, 2006).

Those games devised specifically for education or with recognized educational merit (such as the *Civilization* series and *Minecraft*) will be most successful if they are introduced to teachers along with comprehensive information on how to integrate the game into their classroom, how to teach using the game, the competencies and standards alignment the game should meet, and the affordances as well as constraints provided by the game--and supplementary material needs required by the latter. In both of the above-named cases, there is extensive material available providing just this information. *Minecraft*, indeed, offers an entire teacher-devoted remix of the game and website in *MinecraftEdu,* as

well as several education-oriented offshoots devoted to fields such as computational thinking (http://computercraftedu.com/) and biology (http://www.edutopia.org/blog/minecraft-cell-biology-meets-gbl-dan-bloom).

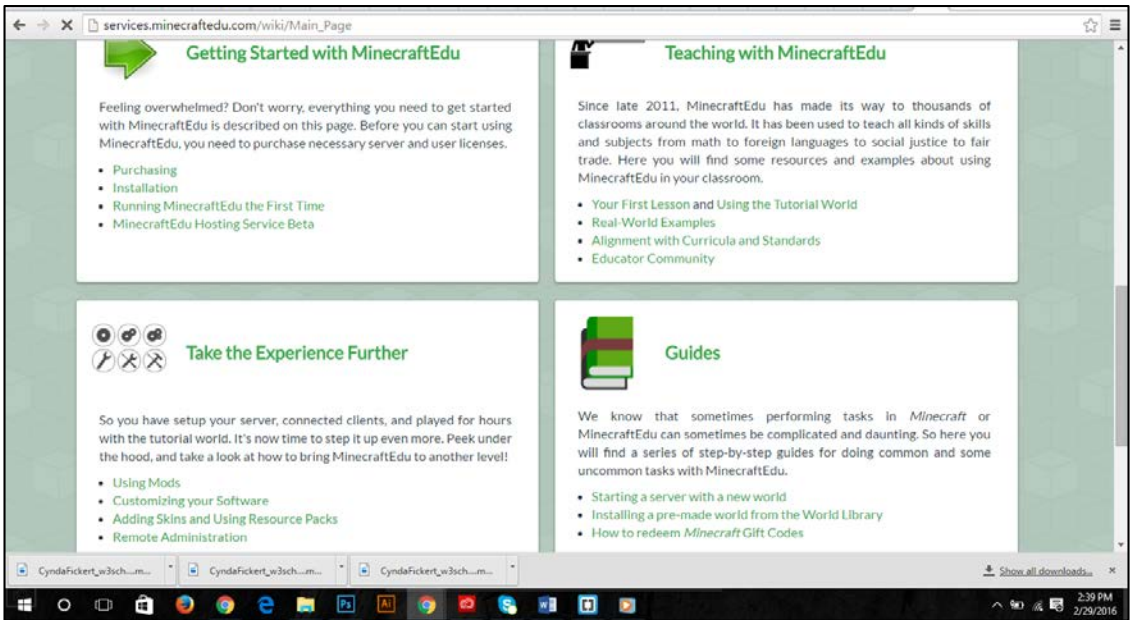


Figure 1: MinecraftEDU *Wiki menu options; http://services.minecraftedu.com/wiki/Main_Page*

Professional development of these types of educational materials is often offered via a wiki-based platform. An example can be found in the *MinecraftEdu* Wiki (Figure 1). The sections contained in this wiki provide an overview of how to get started with the game including purchasing, installation, and first launch; a teaching section containing lesson plans, worksheets, standards alignment, and access to the teacher community; and guides on new directions, adding mods, moving the program to a new server, etc. As well, there is a World Library offering a search function breaking down search categories by discipline, student age level, and game strategy (e.g., exploration, adventure, and mission-based), and

providing lesson plans and gameplay ideas based on search inputs. The wiki has been well organized and the layout is appealing, with pictures, icons, and responsive features. Though content-heavy, the site is broken up into sections, and charts and tables are utilized where appropriate in order to break up paragraphs.

It is important to note that actually playing the game is a beneficial part of teacher professional development (Becker, 2007). Buschang (2012) conducted a study on professional development for teachers using video games in the classroom and found that over 96% of teachers felt actually playing the games to be incorporated into their curricula was an essential part of training in this area. Though this may or may not happen as a rule, the studies of Becker (2007) and Buschang (2012) show that including in provided professional development a way to introduce teachers to actual gameplay—whether or not they actually play the game—is an important component of their learning to use the game in their curricula. Lastly, in order to allay their own and external hesitancies (e.g., administrative, parental), all concerns need to be addressed, and teachers need to know how to do so (Becker, 2007).

SECTION SUMMARY

As the field and affordances of technologies available in the classroom grows, professional development provided to help teachers learn to adapt these technologies to their curricula needs to be capable of providing this instruction

while not increasing teacher burden. In order to be of use to teachers, professional development needs to be contextually relevant and applied to the material. It should take into account **who** the teacher-learner is, **what** the learner needs to accomplish and know through use, and **how** this will be accomplished. Teachers are extremely time-constrained and are generally not able to invest heavily in getting to know all new available technologies as well as their curricular potential. Therefore, any provided professional development needs to be packaged in such a way as to be easily digested and obviously connected to the material they will be teaching. Digital game professional development especially must abide by the above while also drawing clear connections to the curriculum, assessment strategies and alignment (as it is these connections teachers fear are most lacking), and allay all hesitancies toward using a game in the classroom. It should also be capable of providing as much of the game experience as possible as this will aid in teacher implementation whether or not they have time to play it themselves.

Chapter 3: The *Alien Rescue* Teacher Portal

CURRENT PLATFORM DESIGN: *ALIEN RESCUE* WIKI

The current product provided to instruct teachers in the use of *Alien Rescue* is in the form of a wiki (Figure 2). It utilizes a standard wiki format and is mostly content-based as well as largely undecorated. On the left of the screen, choices of content section are presented, which are the same choices that appear on the main page. While this is helpful when navigating the rest of the content options, it may be confusing for first-time users of the wiki to see so many links and choices before they realize these two sections are the same. The wiki itself is largely devoted to housing the teacher's manual only, while other content for teachers

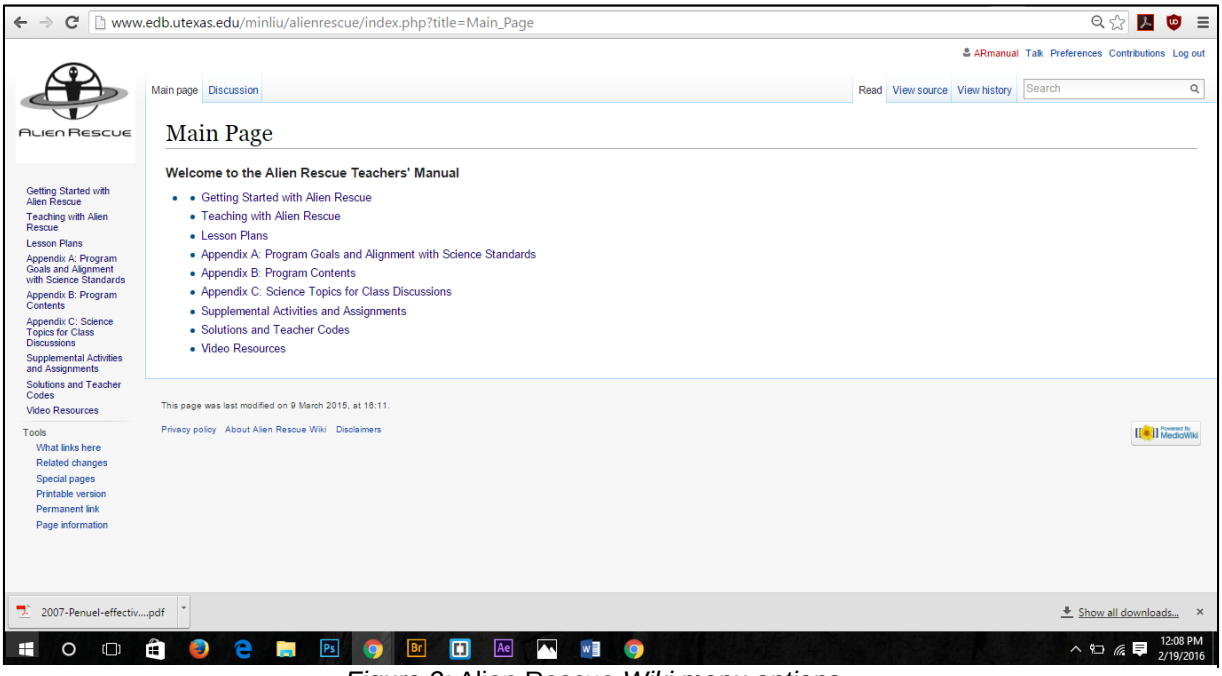


Figure 2: Alien Rescue *Wiki menu options*

(that which does not include grading instruction, problem solutions, worksheets, etc.) is located on the main *Alien Rescue* site page in the teacher's section there.

Material within the wiki is, as stated, content-heavy. Most sections within the manual contain several sub-sections. Navigation of the site is made easier by inclusion of several links both to specific sub-section areas as well as back to the top of the page to eliminate the need to scroll all the way back up in order to re-navigate within that content screen or use the fixed side panel to navigate to a different content area. The choices of links include:

- Getting Started with *Alien Rescue*
- Teaching with *Alien Rescue*
- Lesson Plans
- Appendix A: Program Goals and Alignment with Science Standards
- Appendix B: Program Contents
- Appendix C: Science Topics for Class Discussions
- Supplemental Activities and Assignments
- Solutions and Teacher Codes
- Video Resources

At any time, clicking on the *Alien Rescue* icon (Figure 3) fixed at the top left-hand corner of all pages will navigate back to the Home screen.

Figure 3: Alien Rescue *logo*

Though very rich in information and laid out in a moderately clear format, the design of the manual in this way is not optimal. Its design may offer difficulty in finding answers to specific questions and the display of large bodies of text, all also very similar in design, could make it difficult to retain information and navigate without confusion (Ware, 2004).

PLATFORM REDESIGN: THE *ALIEN RESCUE* TEACHER PORTAL

In general, the development of the Portal followed an abbreviated recursive Dick and Carey model of instructional design (Dick, Carey, & Carey, 2014): First, the instructional goals of the site were decided based on a needs analysis as discussed with the requesting client, Dr. Min Liu, founder of *Alien Rescue*. The identified learner (teacher) skills and performance objectives were used to design the Portal. Finally, research and evaluation of the initial Portal design were conducted with teachers and educators familiar with *Alien Rescue* and the site was assessed and revised based on this evaluation. While I was responsible for overall design of the Portal, site development was carried out by myself and another member of the larger *Alien Rescue* team, Ellen Zou. For purposes of this paper, “the team” will hereafter be used to refer to the two members of the Portal development team.

The materials integrated and presented through the Portal were largely obtained from the current teacher wiki and were updated and organized based on the informed design of the Portal and newly redesigned game. Any necessary

revision to design of the site and content therein in the future will be made by the following generations of *Alien Rescue* graduate student research teams and will be made easier by planned integration of Google analytics into the Portal as well as access to the development files used to create it.

The updated and redesigned *Alien Rescue* will be launched using an HTML5 web-based platform instead of the Unity-based engine it had utilized before. The hope is to both reduce the amount of technical difficulties previously experienced in classrooms with varying levels of technological capacities and to streamline use of the system by housing the game and product website in one location. Thus the Portal, in keeping with the desire to reduce complexity and streamline the overall process, will be housed in a link on the *Alien Rescue* website where the game will also be available and will be password-protected to keep students from accessing the solutions, worksheet answers, and funding codes. It has been developed using HTML5, CSS, and JS/JQuery languages and adapted from an available Bootstrap theme as neither of the team members are particularly advanced developers.

Design Considerations

For teachers to be able to efficiently learn a new tool for classroom use, it must be presented in an easily navigable and contextually relevant way. Teachers have many constraints on their time and are not able to invest heavily in getting to know new tools; it cannot be expected, for instance, that teachers will be able to

play the game or even thoroughly explore it (though that is advised within the Quick Start Guide), and therefore support needs to eliminate the need to do so. In addition, it is not yet accepted practice to use serious games in the classroom (De Grove et al., 2012)., though there has been success with appropriate preparation and curricular integration (Van Eck, 2006). Bias against games in general and hesitancy to use them educationally is often prevalent, and so professional development in this genre needs to be particularly designed to provide the necessary information effectively as well as comprehensively address and dispel concerns of both teachers and parents.

Teachers should not have to work hard to find information they need when they need it, as having to do so may increase any unwillingness to use the game and may also impair effectiveness if the game is not used as designed or suggested. Another consideration is format of presented information. Pages within the site need to be accessible whether on- or offline, and teachers in the project have shown a preference for physical resources. Therefore, information presented in the Portal should be designed to be printable.

Layout

Taking into account the above considerations, all information teachers may need or want as they deploy *Alien Rescue* in their classroom should be accessible from the homepage. Therefore, this page will provide access to the following:

- Quick Start Guide (QSG)

- Lesson Plans & Standards Alignment
- Screencasts & Videos
- Teaching with *Alien Rescue*
- The World of *Alien Rescue*
- Contact
- Frequently Asked Questions (FAQ)
- Printable Pages and Documents

Figure 4: Alien Rescue *Teacher Portal home page*

While a considerable amount of information needs to be contained within these pages, the presentation of that information also needs to be easily understood, navigable, and formatted in such a way that if the instructor required a specific piece of information (say, that day's lesson plan or advice for a student who needs to know what kind of food the Wroft species of alien requires), they can find that

information just-in-time. Therefore, the team has designed the *Alien Rescue* Teacher Portal to be a one-page site with all of the above bulleted sections presented in large, colorful buttons on the home screen (Figure 4). These buttons open modals (Figure 5). A modal is a pop-up window containing its own information that can be opened and closed easily. It is different from a web page in that one does not need to navigate away from it using the “back” or “home” button, but can instead just close it.

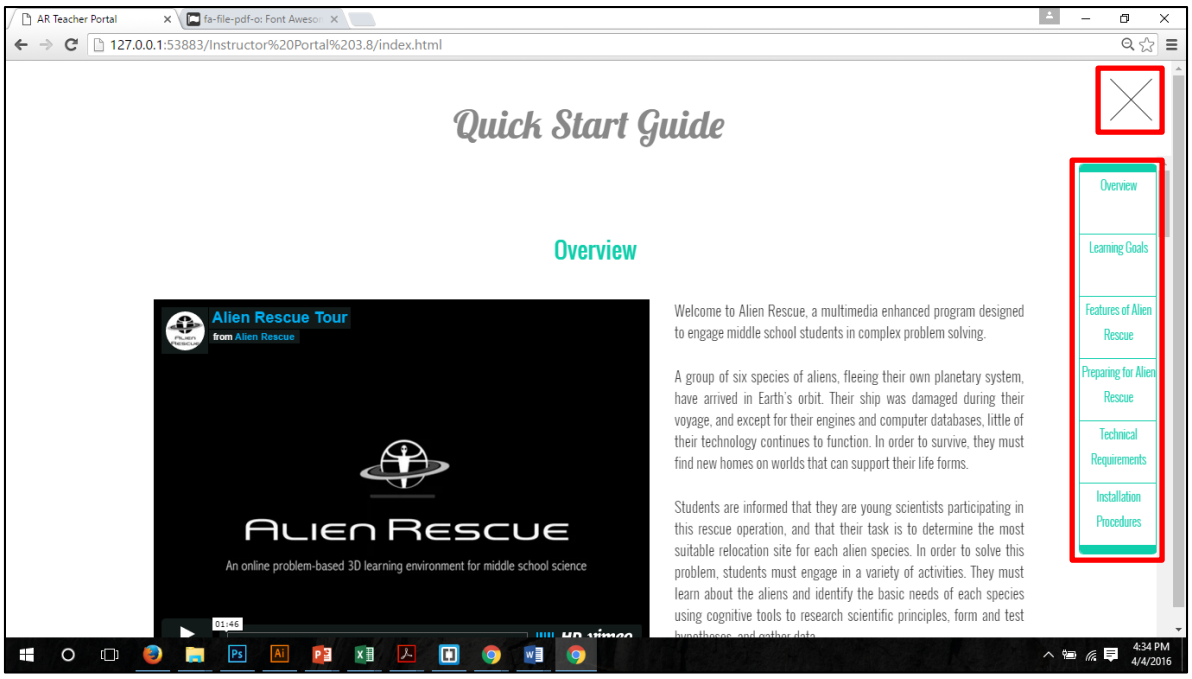


Figure 5: Modal and sections example, highlighted by red box.

The purpose of the modal is to keep the teacher from having to navigate back and forth between multiple screens. Should he or she like to go back to the home screen, he or she simply needs to close the modal using the large ‘X’ icon at the top right of every modal window. Within each modal, information is presented in

organized, self-contained sections to present even large and complex amounts of information as simply as possible (figure 5). A search bar will also be incorporated into the site, allowing for the search of specific information.

Sections

Each section within the Portal has been carefully designed to meet the aforementioned design considerations informed by the literature and the needs of the learners. These sections are further discussed below.

Quick Start Guide

By providing a Quick Start Guide (QSG), teachers who lack the time to comprehensively read the Teaching with *Alien Rescue* section before launching the game in their classroom can implement it in a short amount of time and can choose via links within that guide exactly how deep into the theory or content of the game they would like or are able to peruse at the time. The QSG is multimodal and interactive (Figures 6 and 7), utilizing video as well as images/icons and small chunks of text to tell teachers what they need quickly and succinctly.

The page contains an overview, a short introduction video, technical requirements, and a guide to beginning *Alien Rescue*. It also contains a link to the Lesson Plans & Standards Alignment and Screencasts & Videos sections of the

Figure 6: Quick Start Guide Modal example 1

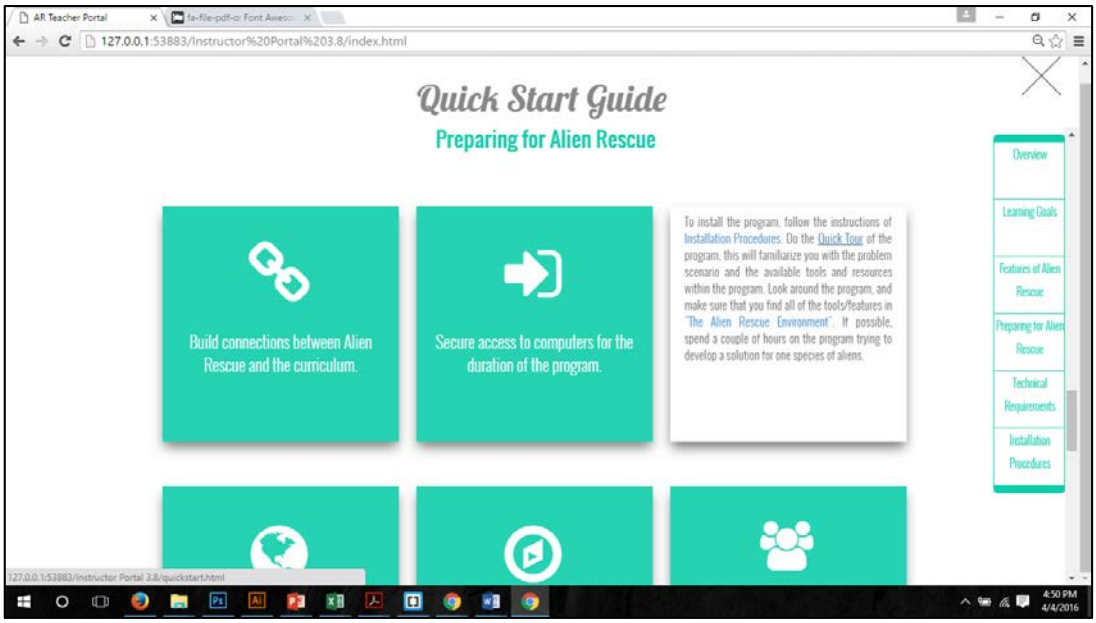


Figure 7: Quick Start Guide Modal example 2

Portal. The QSG as well as the FAQ (to be discussed further) are designed to provide the teacher with just-in-time information and ensure they have all that they need in order to effectively implement the game and answer questions about the game's curricular affordances for their own edification as well as that of other teachers and parents.

Lesson Plans & Standards Alignment

The Lesson Plans section provides the suggested activities associated with each day of the 16-day period *Alien Rescue* is designed to comprise (Figure 8). This is necessary on the home screen as teachers may need to access this content day-of in order to decide on the day's activities and should not need to search for it. As well, this section also houses the standards alignment sheets. These can

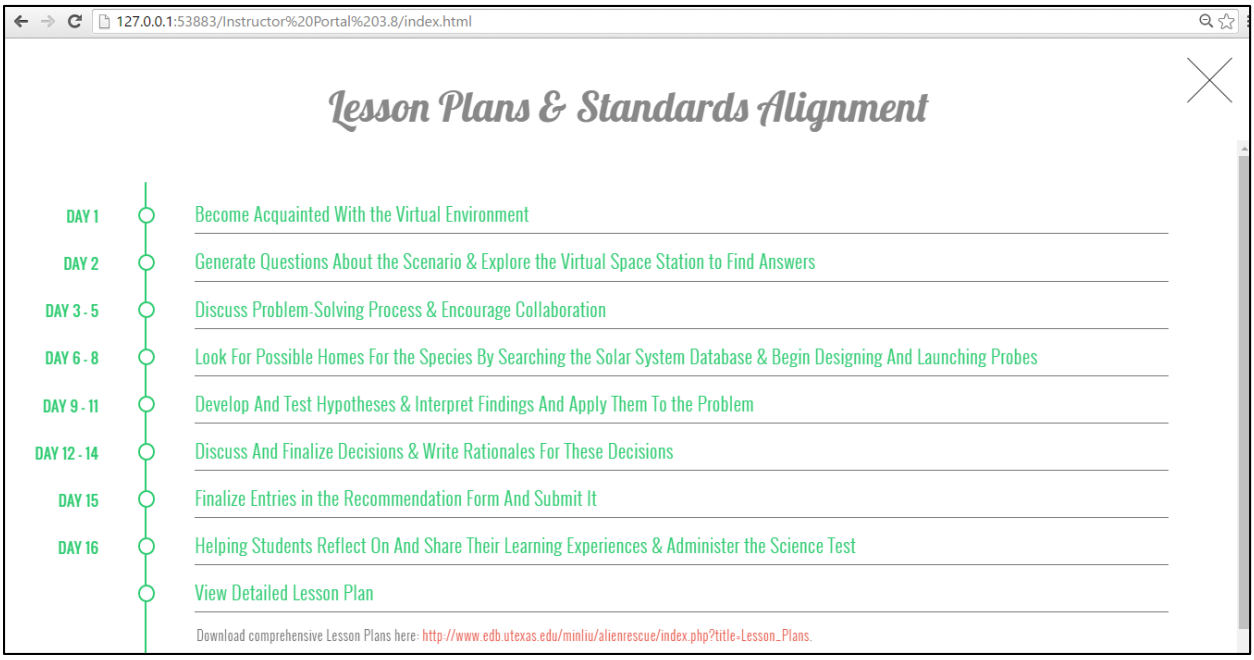


Figure 8: Lesson Plans & Standards Alignment

also be accessed within the Teaching with *Alien Rescue*, FAQ, and Printable Pages and Documents sections, but need to be apparent on the main page for teacher awareness and to quickly negate any fears associated with alignment.

Screencasts & Video

The Screencasts & Videos page of the manual is arguably one of the most important sections of the site. Knowing that teachers may not have the time or inclination to undergo an in-depth exploration of the actual game, but that being acquainted with the look, feel, and function of the game and its associated contents is necessary for effective deployment, this section provides video resources that provide that information.

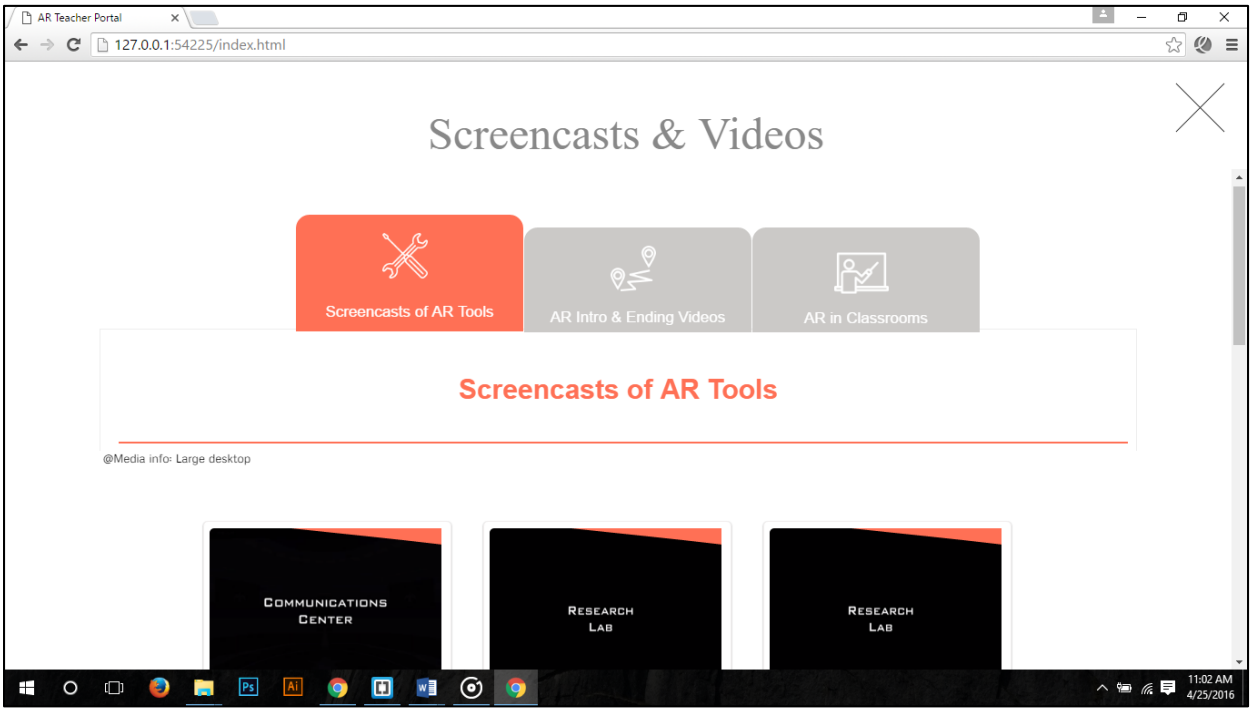


Figure 9: Screencasts & Videos page

There is a large amount of science-based content contained within the environment of *Alien Rescue*, and there are several ways to interact with this content via tools, databases, and activities that can be performed on the space station *Paloma* where the serious game takes place. While it is suggested that students get to know this environment and these tools on their own, there will invariably be difficulties and questions for which the teacher needs to be prepared. Therefore, screencasts and videos have been made of all of the interactions and associated content to aid in that preparation, as well as the Introduction and Final game videos and other recordings of in-class gameplay and teacher/student interaction (Figure 9).

Teaching with **Alien Rescue**

The Teaching with *Alien Rescue* page within the home-screen menu contains comprehensive information on all aspects of using the game in the classroom. This is by far the most content-heavy section of the website, but here, too, content is organized into subsections to make it more digestible and user-friendly (Figure 10). Though it was not possible to reduce the amount of content presented here, strategies were used to make it more concise. However, it is presumable that teachers will not reliably have time to invest in such a comprehensive overview of this content. Instead within these pages the most prescient information—the details students will need to solve the problem presented in *Alien Rescue* and the in-game location of those details—is provided

in an easily digestible format (Figure 11) while links to printable PDFs of the complete information are be available as well.

The team also made these pages aesthetically pleasing, keeping to a similar color palette throughout but with each section having a different design to help teachers connect material with its location and, hopefully, more easily retain it. The subsections within this modal are: Introduction, featuring the main story, student mission, and relevant background information; Lesson Plans, so that teachers can get the full overview without having to navigate back to the home screen; Teaching Strategies; Discussions, which provide ideas and content for class discussions (Figure 12) about *Alien Rescue* concepts; Worksheets and Tests; and Solutions and Codes.

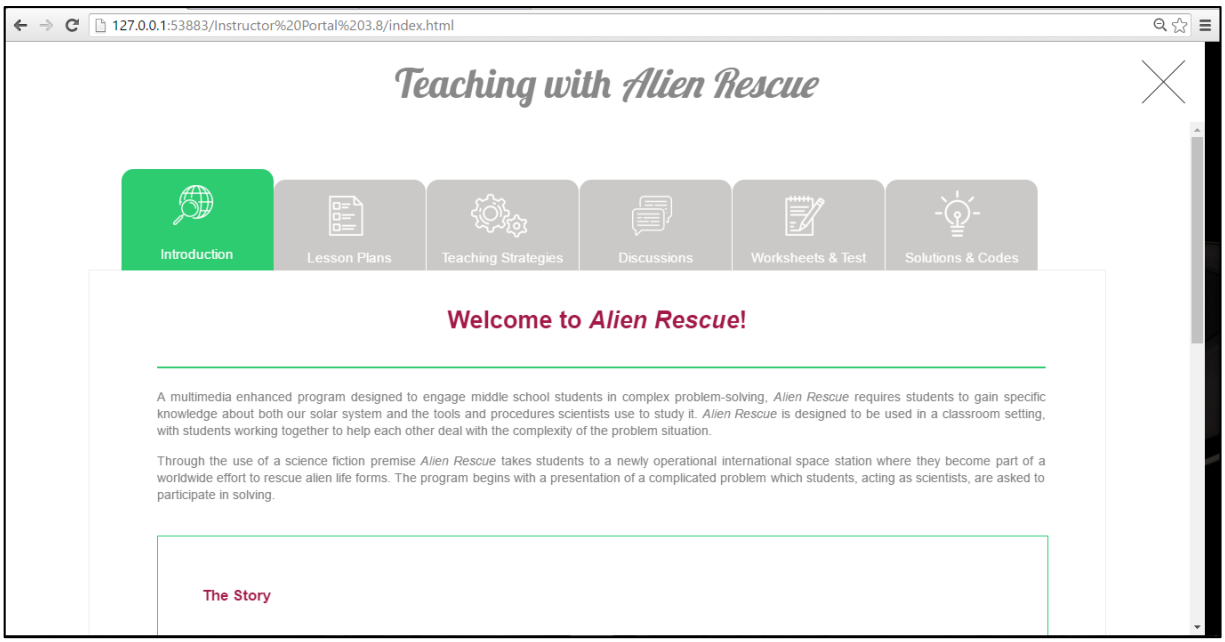


Figure 10: Teaching with Alien Rescue *Introduction page*

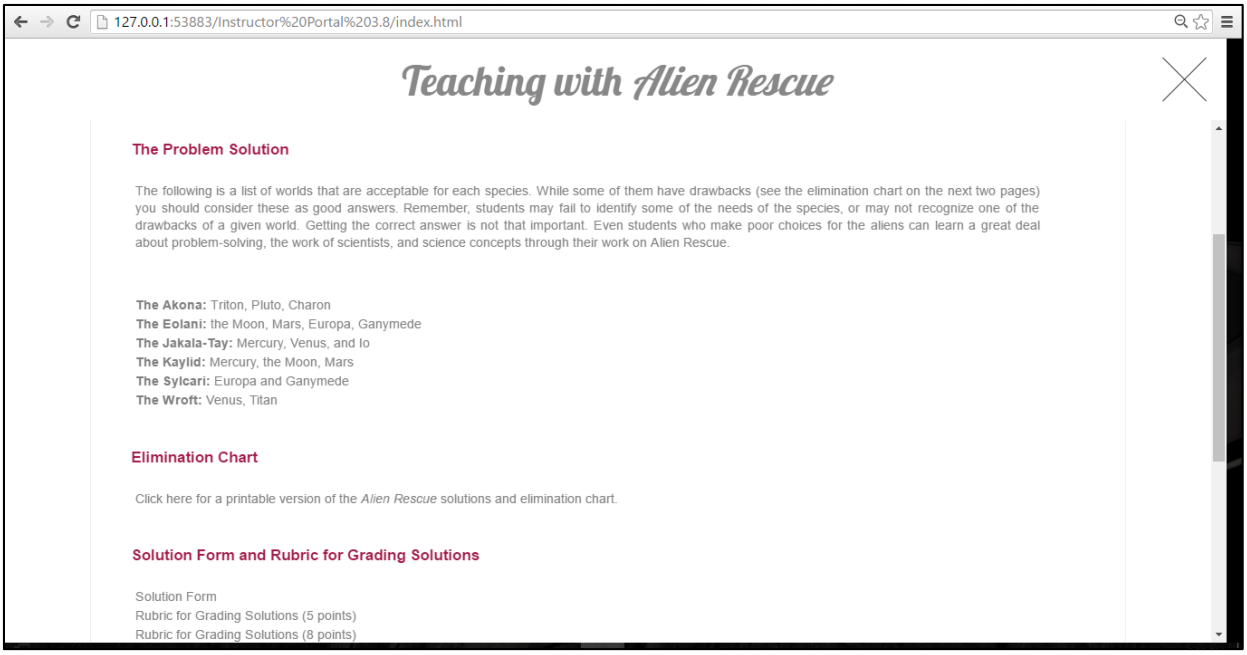


Figure 11: Solutions and Codes

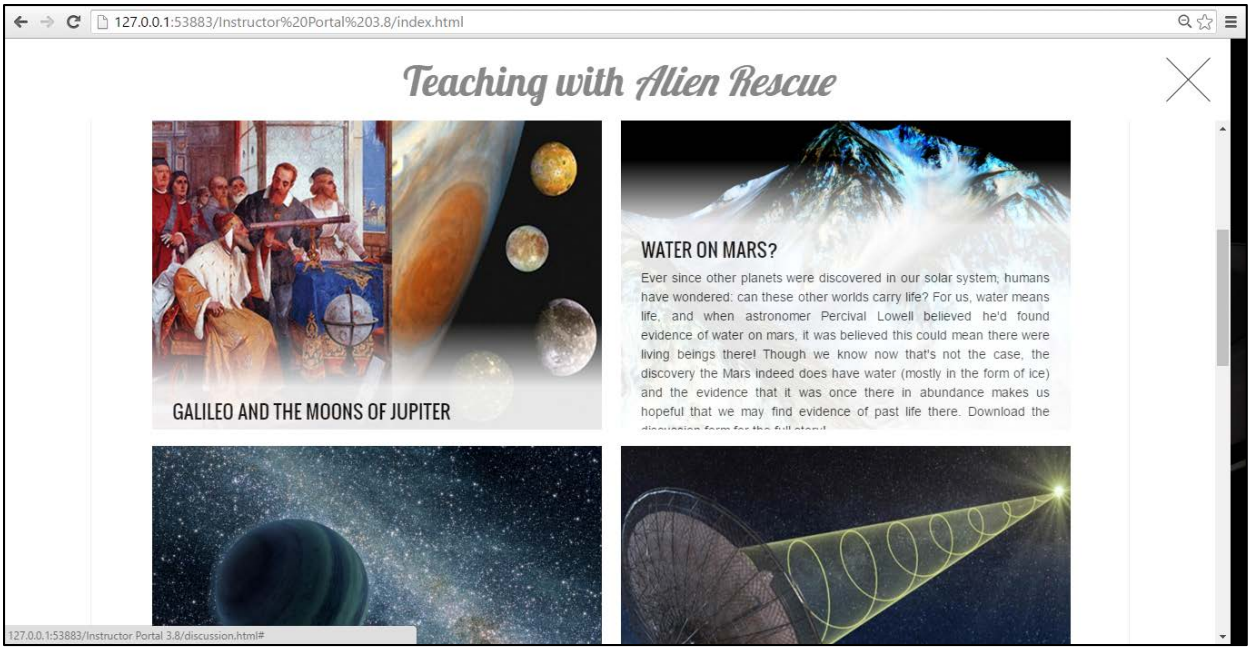


Figure 12: Discussions page with interactive images

Contact

The Contact Form (Figure 13) allows teachers to share feedback, ask questions, give advice, or whatever else they need to do once they are using the game in class. It provides a very important link between the teachers and developers of the game and ensures that any problems or questions they have can be addressed as quickly as possible.

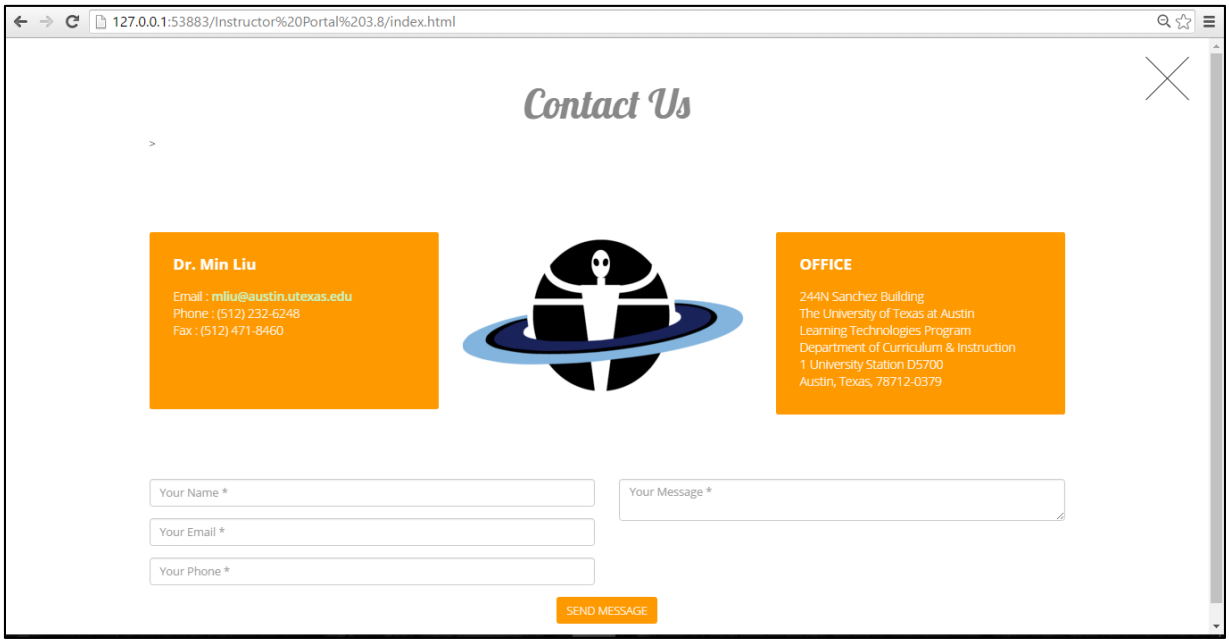


Figure 13: Contact page

Frequently Asked Questions (FAQ)

The FAQ is a list of frequently asked questions and their answers. This is an important resource for teachers with any confusion, hesitancy, or questions to find answers without having to search within the other content in the site (figure 14). Some teachers may prefer to begin with this section and make sure their most pressing concerns have available answers. This is why representational questions and answers are very important to include.

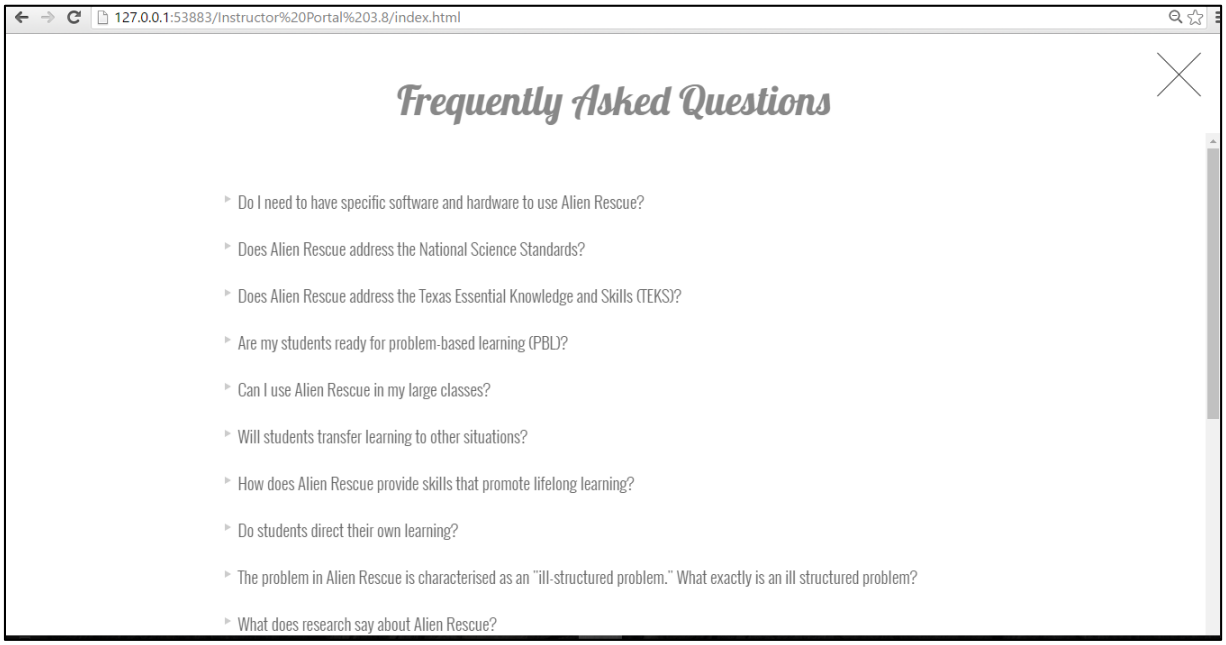


Figure 14: FAQ page

Printable Pages and Resources

Because this site and the information required to present herein is so content-rich, there was not a clear way to maintain it all within the pages while retaining a concise and easily navigable feel. Therefore, I chose to follow the lead of the original wiki developers and retain that information as downloadable and

printable PDF versions. This satisfies the objective of not overburdening teacher-users as they seek the information they need while also providing resources that can be easily printed for use while walking around the classroom or keeping in a binder for reference. Though these resources will be interspersed throughout the site, it should not be necessary to need to re-locate them each time one wants to get the information presented there. As well, physical copies may be lost or not adequately organized and difficult to find once printed and stored elsewhere. With this in mind, all documents that are printable/PDF-formatted will also be located and well-organized within the Printable Pages and Resources page (figure 15).

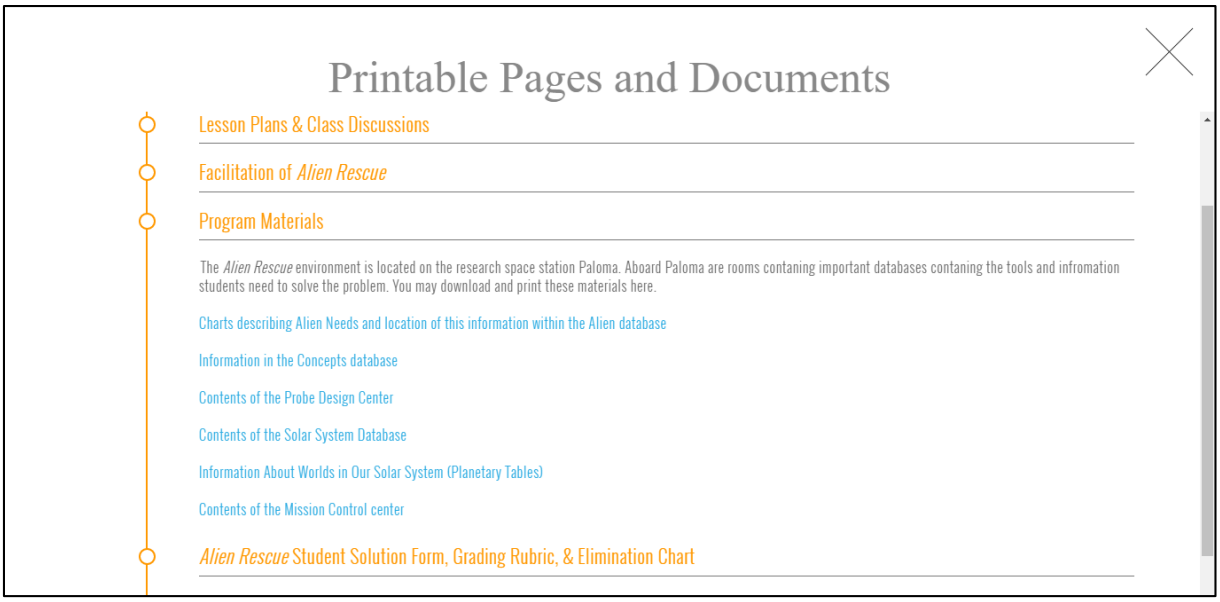


Figure 15: Printable Pages and Documents page

Again, in the interest of keeping things simple and reducing the need to navigate back and forth unnecessarily, all links to PDFs in the Portal open in a separate tab automatically so the current page is not navigated from.

FIELD TESTING

An invaluable and necessary part of this process is ensuring field testing and subsequent revisal of the Portal occurs before it is launched. Chosen for field testing were three individuals whose experience and expertise made them ideal candidates for this evaluation. Two are previous educators and current PhD candidates working in instructional design and technologies at the University of Texas at Austin. The third is a middle school teacher who will be using the newest iteration of *Alien Rescue* in her classroom. Table 1 provides a short description of each tester chosen. These individuals were asked to run through the Portal according to their own perspectives and actual or hypothetical objectives. Specifically, I asked them to provide feedback on:

1. Overall impressions of the Portal
    a. Navigability
    b. Content and content presentation
    c. Anything it may be lacking
2. Information they would give to a new teacher hesitant about the game
3. Information they would give to a parent hesitant about the game (and what, if anything, they would add to the FAQ in this regard)
4. Any instance in which they were not been able to find needed information
5. Accessibility, usability, and aesthetic concerns

These five feedback directions were chosen as representative of the most logical areas in which information or design of the Portal might be lacking. It is first and foremost extremely important that anything presented within the site can be easily and intuitively navigated and understood. It will not be helpful just to include information if teachers cannot also access it when they need to. Next, in order to broaden adoption of *Alien Rescue*, the teacher perspective of how their own and others' concerns of using this serious game cirricularly can be best assuaged is an important consideration. If any of these concerns can be tied into the FAQ section of the Portal and main *Alien Rescue* information site, the interest of potential adopters may be increased. Finally, accessibility, usability, and aesthetic concerns are essential; all users must be kept in mind in the creation of a site, and any failure in accessibility and usability will seriously undermine the purpose and effectiveness of the Portal.

Tester Name	Role with *Alien Rescue*	Description
Jason H.	Previous team member: Design and development	Jason is a doctoral student in the Learning Technology program at The University of Texas at Austin. He is an experienced K-12 educator and works for the UTeach program as a Teaching Assistant training pre-service math and science teachers. He is interested in immersive virtual reality environments and design thinking.
Ryan M.	Previous team member: 3D modelling	Ryan is a Ph.D. student in the Learning Technologies program at the University of Texas at Austin. Ryan taught middle school social studies for six years. He is interested in digital game-based learning environments and problem-based learning.
Jennifer S.	Teacher-user of 15 years	Jennifer has taught middle school for over 15 years and has been using *Alien Rescue* in her classroom for nearly as long as she has taught in it. She was among the first group of teachers who tried out *Alien Rescue* and has used it each year since. She has attended *Alien Rescue* professional development workshops a number of time over the years and helped review the newest version of the elimination chart in 2015. She is the first teacher who uses the new version in spring 2016.

Table 1: Teacher Portal Field-tester descriptions

Chapter 4: Field-Test Results

Evaluation-Informed Revisions

The field testing feedback I received was extremely helpful in bringing to light bugs or problems the team had overlooked or not considered during the design and development process. Because development decisions were at times disjointed with one or the other of us working on different pages at different times, our field-testers noted some discordancy in page design. How and where to place menus, color choices, text effects, etc., while stemming from a general overall design, often came down to the preferences and coding skills of the individual developing the page.

While alignments were made throughout the process to make the pages more cohesive, there were places where design varied noticeably. Therefore, the team spent time making sure colors, menus, etc. were more representative of the site as a whole and there were no solitary occurrences of any stylistic choice. The team did feel that the design of the homepage widened the color palette of our site considerably and so chose not to constrain this palette, but rather to ensure that there was a cohesive representation of these colors over the course of the site. This choice was positively supported by Jennifer S., who commented that teachers were likely to be very favorable of the color scheme and that it was an improvement over the static and monochromatic wiki site.

We also incorporated more visual cues and menus where they had not been present before. Field-tester feedback, particularly that of Ryan M. of the Learning Technologies PhD program, indicated that our users would benefit from further navigation and orientation effects (methods to highlight where the user was within a page or incorporating hover-based color changes to show that a section or word was interactive). Hover-dependent color change to text was therefore added as a way to indicate interactive text, particularly in accordion-style pages such as Lesson Plans & Standards Alignment (Figure 16). Small typos and instances of messiness were also noted by our reviewers (Figures 17-19) and corrected (Figure 20).

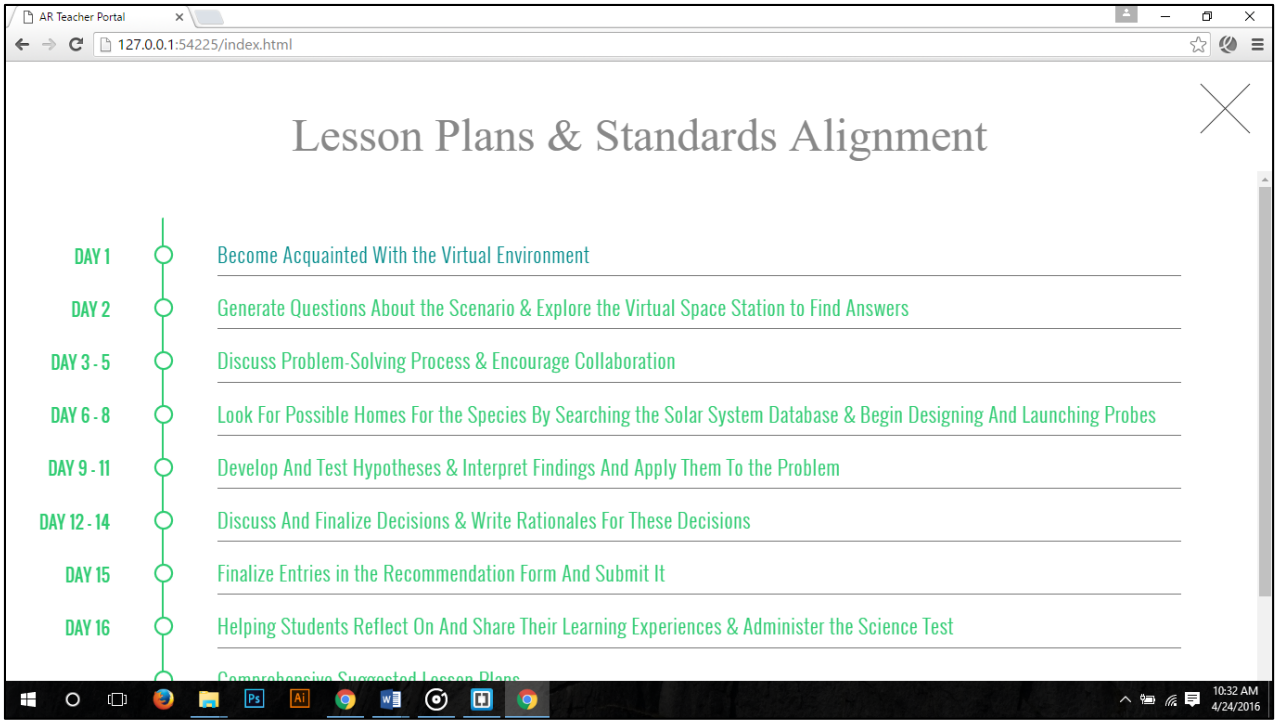
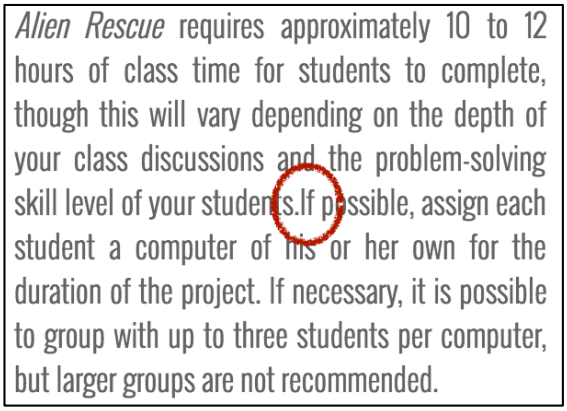
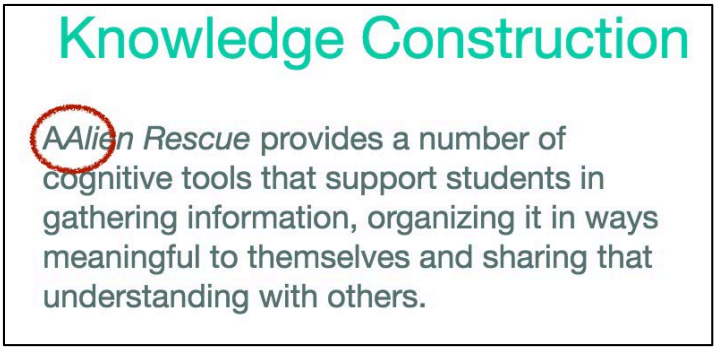


Figure 16: Text-color hover effect for interactive text





Figures 17 and 18: Minor issue examples 1 and 2

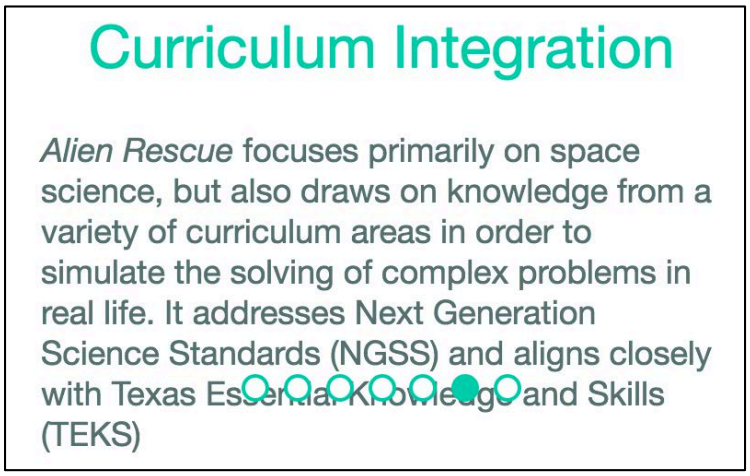


Figure 19: Incorrect display in QSG carousel

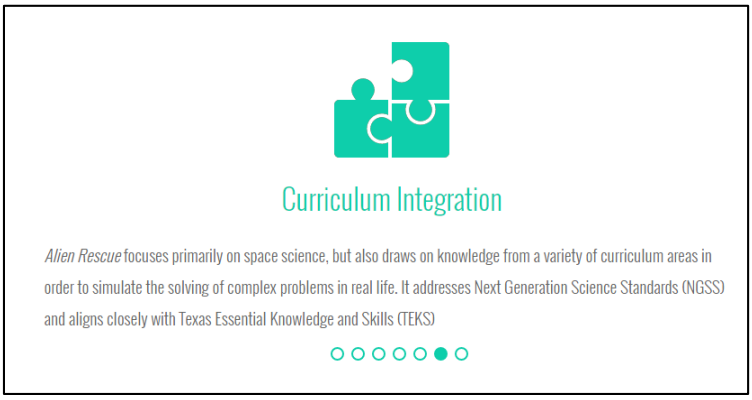


Figure20: Corrected display in QSG carousel

All three reviewers noted that it would be pedagogically beneficial if the pop-up boxes used in the *Paloma* Environment, Alien Database, and Solar System Database sections of The World of *Alien Rescue* would stay in place when clicked rather than being hover-dependent and disappearing once the cursor was moved. This would be helpful for comparing side-by-side the information contained in these boxes and simply for being able to reference it without needing to keep the cursor over a specific area (Figure 21). Therefore, we incorporated the feature of an active state in these table that would remain active when the picture was clicked.

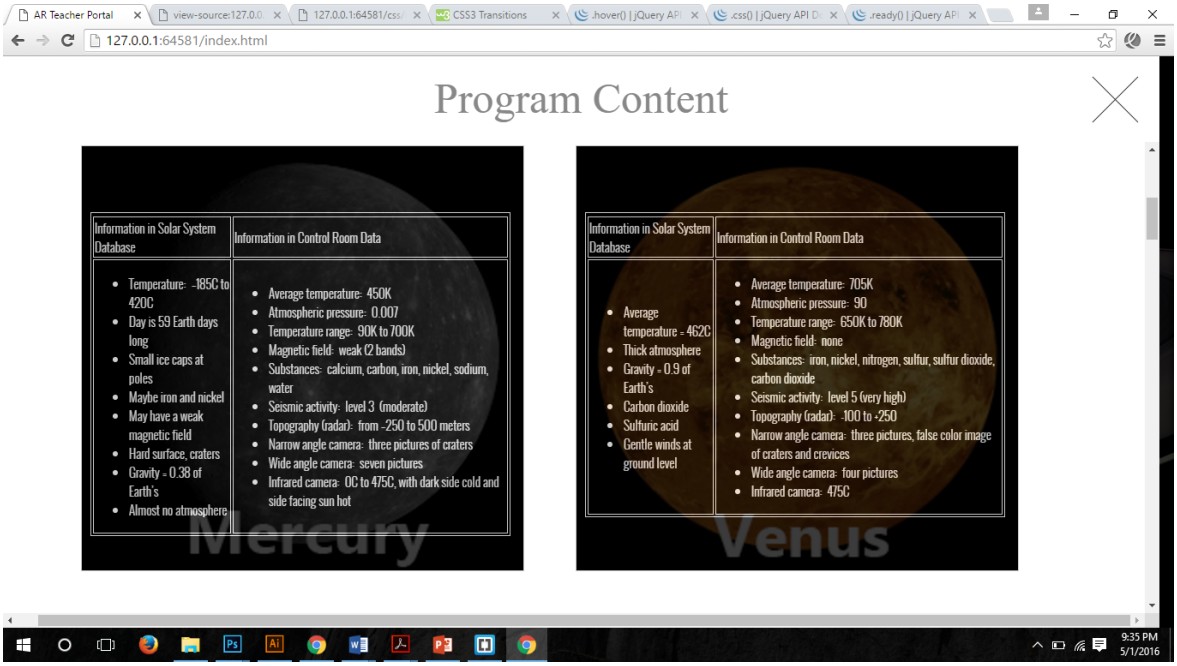


Figure 21: Example of active-state pop-up tables

As an accessibility and page responsivity concern, both Learning Technologies Program testers noted that the menu's placement on the QSG was problematic. Firstly, because it was placed on the right-hand side, this deviated from established expectation of users, since most vertical menus are often housed

on the left side of the page and that is most beneficial for standard left-to-right reading. Secondly, when the page was sized smaller, the menu cut into the text on the right hand side. Thus, we moved that menu over and corrected that issue (Figure 22).

Finally, our users noticed problems with the Screencasts & Videos section of the site. Firstly, the video tended to open in the middle of the page, causing the

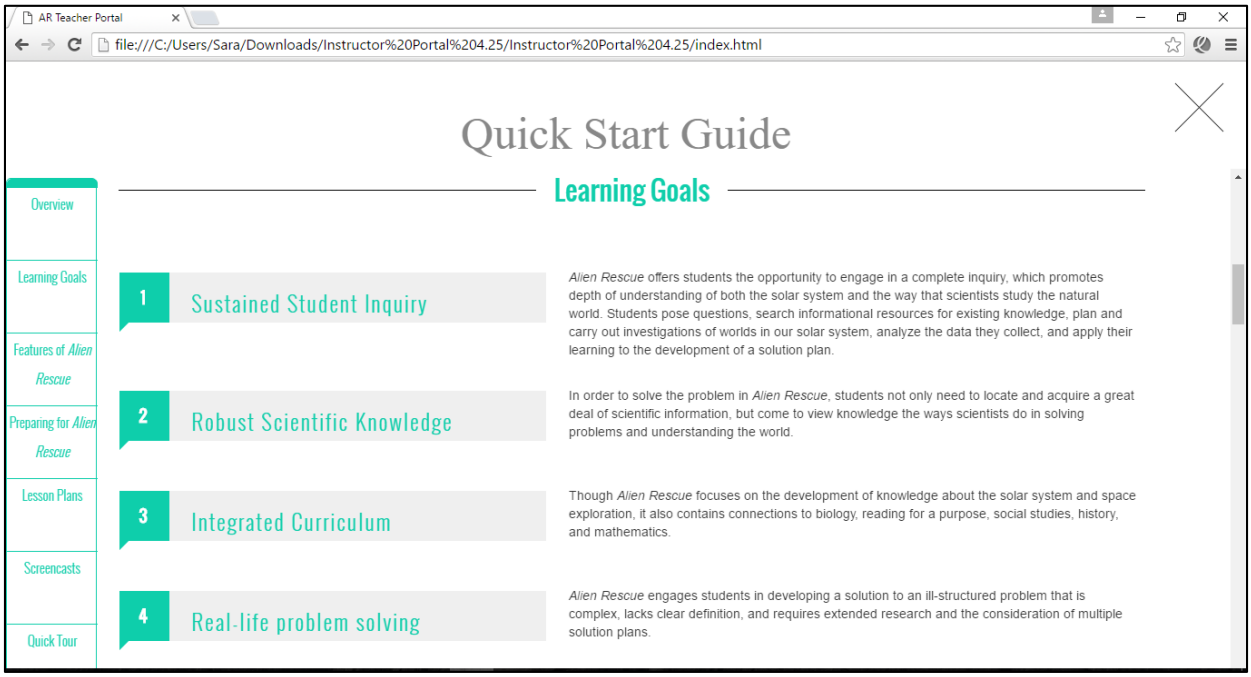


Figure 22: QSG menu moved to left side of screen

user to need to scroll to even see that it had done so. Second, due to a bug in the code, the video itself would continue to play even after having been closed; users needed to pause the video and then close it or else the audio would continue playing. Reopening a video was also problematic as once it had been played partly or completely, the video would reopen to wherever it had left off. These issues

proved to be too much for our coding skills, and the team decided on a different code/layout for the page (Figure 23). It does not utilize thumbnails, which had been a handy feature, but it does work as intended (Figure 24).

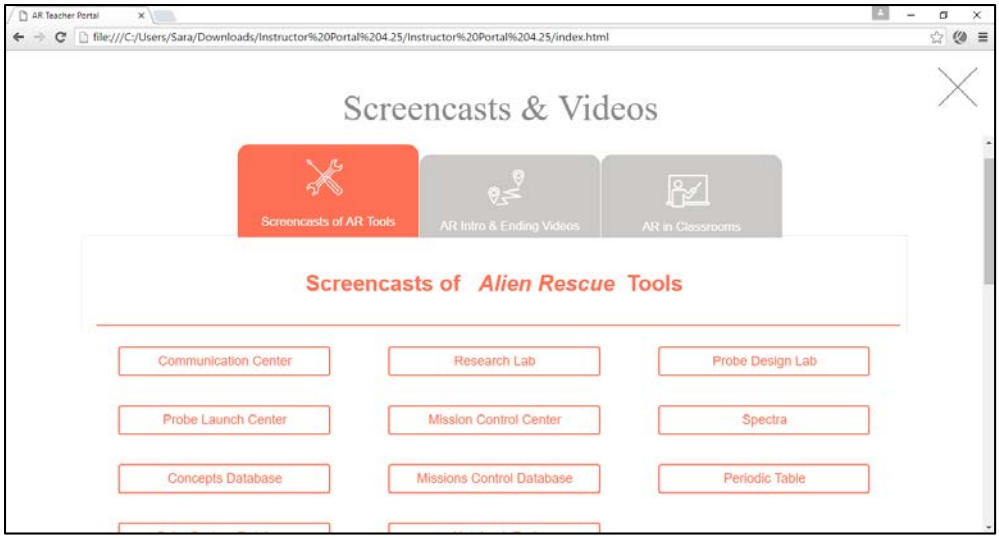


Figure 23: Screencasts & Videos--new layout

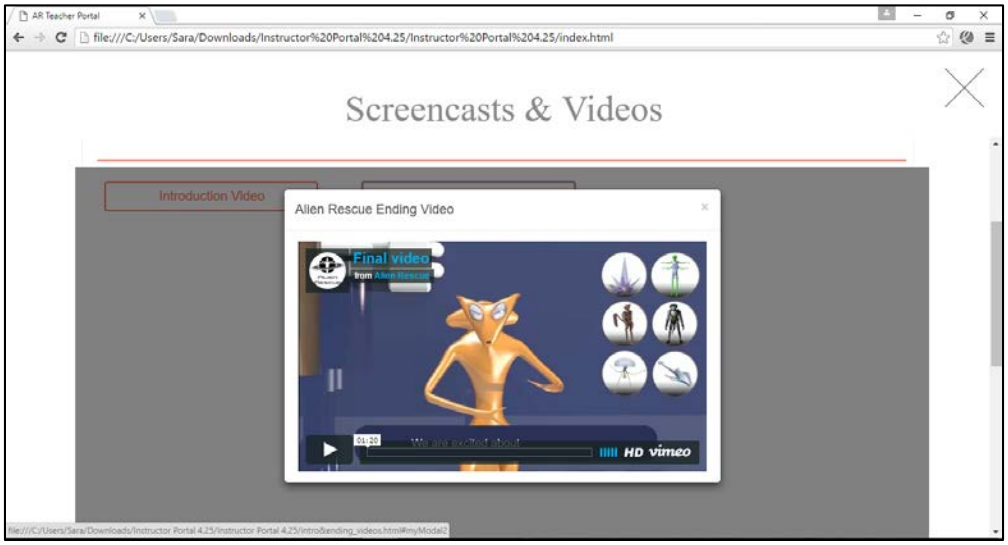


Figure 24: Screencasts & Videos--corrected playback

Chapter 5: Discussion

Experience/Reflection in Context of Literature Review

This report has documented the process of design and development of a teacher professional development platform for use with the serious game *Alien Rescue* through informed design research and sound instructional principles. The product as developed is aligned with these principles. The Portal is a self-contained, comprehensive platform that is highly correlated with the learning needs of its intended teacher users. It aligns with the tendency for teachers' knowledge and planning regarding their instruction to be situational and episodic (Harris & Hofer 2009), allowing for just-in-time perusal and obtainment of information. As well, it provides comprehensive material for deeper dive into the program and prominent display of, and multiple access points to, standards alignment and assessment material (Kenny & Gunter, 2011).

Step-by-step directions are provided for in-game exploration of the *Alien Rescue* program so that teachers can get to know the game and environment before teaching with it (Becker, 2007; Buschang, 2012), while detailed screencasts and videos are also provided to help teachers gain the same perspective should they not have time to open the game or peruse it to their preference. The team endeavored to add color, interaction, and menu design to make the site aesthetically pleasing and to reduce cognitive load wherever possible. Thus text

presented in the site was kept succinct while downloadable PDFs were created wherever possible, adding an element of control to whether, where, and how these are engaged with. Items of most importance—that of standards alignment, day-by-day lesson plans, worksheets and tests, and screencasts are represented in multiple locations to ensure these can be found easily, repeatedly, and do not have to be searched for. Feedback from field-testers was generally positive and found agreement that the goals mentioned here were represented. Any constructive feedback was incorporated to the best of the team's ability or noted for incorporation before launch and/or by future *Alien Rescue* Portal development teams.

FUTURE DIRECTIONS

The *Alien Rescue* Teacher Portal will necessarily need revision as the game itself continues to evolve. Though the changes to *Alien Rescue* during this cycle of upgrade did alter the look and feel of the experience, many changes were proposed that time simply did not allow. As these proposed developments are incorporated, the Portal will need to evolve along with it, specifically in the Screencasts & Videos section in order to align these with the version students will be playing.

As well, there were some problems with the Portal that were unfortunately not surmountable by the team in the time allowed for development and with the novice level of experience possessed on beginning this process. The most

prevalent of these was site responsiveness; though built on and sized for a normal laptop computer screen, our field testers noticed that responsiveness to smaller screens and window sizes was definitely an issue. Though we do not anticipate this Portal being regularly accessed or perused on many mobile devices, in order to keep relevancy and modernity at the forefront, responsiveness should be built into the system.

Due to feedback that users would benefit from increased navigation options and visual cues, the team planned on adding menus to The World of *Alien Rescue* section where they are not currently present, specifically to the *Paloma* Environment, Alien Database, and Solar System Database pages. These pages are reliant on vertical scrolling, but currently have no indication of which or where rooms/species/planets are represented within the page. Therefore, a vertical traveling menu similar to that used in the QSG would be beneficial. However, the team was unable to make this feature work within the confines of the modals as they were designed. Adding this feature to these pages will increase usability and ease navigation, and should be considered by future team members as they iterate upon this version of the Portal.

There are also some features that would increase the benefits of this platform. One that was most requested by Jennifer S. was a teacher dashboard. Though that feature is not ready at this point, teachers strongly desire a way to check up on student progress with *Alien Rescue* remotely. Once this is developed,

it will need to be housed within the Teacher Portal. Another feature proposed that would be especially worthwhile once the serious game has more wide-spread and synchronous adoption would be a chat or forum feature. This would allow instructors from the different schools featuring or interested in the program to discuss merit, application, alternative directions, lesson plans, and issues or questions with one another so that the pedagogical applications and methods of implementation can broaden.

Finally, it is expected that issues may arise as teachers spend a longer amount of time with the Portal than was allowed for field testing and that thus have not been discussed or predicted here. As these issues come to light, it will be up to the team's predecessors to address and correct them. It is my hope that all steps have been taken, as have been described in this report, to streamline any future revisions and iterations, and that the platform that has been developed can serve as a successful foundation for these changes.

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